CARBOPLATE

Pultruded carbon fibre plate with a double plastic protective film

WHERE TO USE

This system is recommended for the repair and strengthening of reinforced concrete elements damaged by physical and mechanical stresses, to improve the flexural strength of reinforced concrete and wooden elements, and to upgrade the seismic capacity of structures in high-risk areas.

Some application examples

- Repairs and static upgrading on reinforced concrete beams, floor joists, and floor slabs to increase flexural strength.
- Flexural strengthening of wooden beams and joists.
- Repairing structures damaged by fire.
- Repairing structures damaged by earthquakes.
- Renovating two-dimensional structures such as plates, sheets, and storage tanks with a large radius.
- Strengthening the deck of viaducts after increasing their static and/or dynamic loads.
- Strengthening industrial and/or commercial structures after increasing their static loads following the installation of new machinery, equipment, etc.
- Strengthening vehicle access ramps in civil and industrial buildings.
- Strengthening structures subject to vibrations.
- Strengthening load-bearing members in buildings whose structural system has been modified due to new architectural requirements or changes in use.

TECHNICAL CHARACTERISTICS

Carboplate is a range of pultruded carbon fibre plates, with high resistance and high modulus of elasticity, for plating reinforced concrete structures, also pre-stressed, steel, and wood structures.
Carboplate can replace conventional steel sheets that are used for plating.
Carboplate plates are available in different widths with three moduli of elasticity (170, 200, and 250 GPa):

- **Carboplate E 170**
- **Carboplate E 200**
- **Carboplate E 250**

Thanks to their special composition and the manufacturing process, **Carboplate** plates have guaranteed properties at every point and have the following characteristics:

- high tensile strength;
- low weight;
- reduced thickness;
- excellent fatigue strength.

Carboplate plates may be applied using **MapeWrap 11**, **MapeWrap 12**, **Adesilex PG1,** and **Adesilex PG2** bonding adhesives, which comply with the principles defined in EN 1504-9 ("*Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - General principles for the use of products and systems*") and the minimum requirements of EN 1504-4, ("Structural bonding").

ADVANTAGES

Unlike work carried out using conventional techniques, thanks to its extremely low weight, the products from the **Carboplate** range can be installed in a very short space of time without having to use any particular tools or equipment, and often without interrupting the use of the structure.
Compared with the cladding technique with metal plates (*béton plaqué*), **Carboplate** plates do not require temporary supports during application and there is no risk of corrosion to the strengthening system.
Compared with cladding using fabric impregnated directly on site, **Carboplate** plates are quicker and easier to apply and the quality of the work is less dependent on the experience and skill of the installation team.
Carboplate plates also have quite a good level of flexibility, which means the system can also be used to bind cylindrical structures (storage tanks, silos, etc.) with a bending radius of more than 3 metres.

RECOMMENDATIONS

- Before bonding the plates, make sure the tensile strength of the concrete substrate is > 1.5 MPa.
- Do not use the **Carboplate** on concrete that has not been correctly cured.
- On particularly absorbent surfaces or on concrete placed in environments with a high R.H. (underpasses, basements, underground spaces, etc.), apply **MapeWrap Primer 1** to prime before bonding **Carboplate** (refer to the relevant technical data sheet for the preparation and application of the product). When applying **MapeWrap 11**, **MapeWrap 12**, **Adesilex PG1**, or **Adesilex PG2** epoxy adhesive, **MapeWrap Primer 1** must still be wet.

APPLICATION PROCEDURE

Preparation of concrete substrates

Surfaces on which **Carboplate** is to be applied must be perfectly clean, dry, strong, and even (maximum surface roughness 1 mm).
Sandblast the surface to remove all traces of stripping oil, varnish paint, and cement laitance.
If concrete is damaged deep down into the element, remove all damaged parts using a hammer, a jack-hammer, or by hydro-scarifying.
Remove all traces of rust from the steel reinforcement and protect them by applying **Mapefer** two-component anti-corrosion cementitious mortar or **Mapefer 1K Zero** one-component anti-corrosion cementitious mortar (refer to the relative Technical Data Sheet for application procedures).
Repair the concrete surfaces with products from the **Mapegrout** range.
Wait at least three weeks before applying **Carboplate** plates. If for logistics purposes the strengthening intervention needs to be carried out immediately, use either **Adesilex PG1** or **Adesilex PG2** epoxy mortar to repair the damaged concrete.

Products for bonding

If the temperature is between +5°C and +20°C use **MapeWrap 11** or **Adesilex PG1**.
MapeWrap 12 or **Adesilex PG2** should be used at temperatures higher than +20°C as their pot life is longer.

Preparation of MapeWrap 11 or MapeWrap 12 or Adesilex PG1 or Adesilex PG2.

The two components of **MapeWrap 11** / **MapeWrap 12** or **Adesilex PG1** / **Adesilex PG2** must be mixed together.
Pour component B into component A and blend them together with a drill fitted with a mixing attachment until completely blended (an even grey colour, without stripes).
Do not use partial quantities: to avoid the risk of accidental dosage mistakes, use the whole package; if only partial quantities are required, use a precision electronic scale to weigh the components.

Bonding Carboplate plate

Carboplate is supplied in rolls that need to be cut to length with an angle grinder fitted with a diamond disk.
Also, during the manufacturing process, a plastic film is applied to both sides of **Carboplate** to protect the plate from dirt when handling and cutting them. Before bonding **Carboplate**, remove the film from the side

that will be in contact with the epoxy adhesive chosen for the work.
Prime the surface to be strengthened with **MapeWrap Primer 1** (in the case of particularly absorbent substrates or concrete in surroundings with a high level of R.H.).
Apply an even layer approx. 1-1.5 mm thick of **MapeWrap 11** / **MapeWrap 12** or **Adesilex PG1** / **Adesilex PG2** adhesive (depending on the surrounding temperature) with a flat spreader on the side of **Carboplate** from which the plastic film has been removed.
Apply another layer of **MapeWrap 11** / **MapeWrap 12** or **Adesilex PG1** / **Adesilex PG2** on the substrate (clean and dry) to which the plate is to be bonded. The adhesive must be applied while **MapeWrap Primer 1** is still wet.
Lay **Carboplate** on the adhesive, press down evenly along the whole length of the plate with a rigid rubber roller, and remove any excess resin with a spreader, taking care not to move the plate.
When plating curved elements or structures, the plates must be held in position with temporary clamps or stays until the resin has completely hardened (24 hours is usually enough before the clamps or stays can be removed).
If more than one layer of **Carboplate** is required, once **MapeWrap 11** / **MapeWrap 12** or **Adesilex PG1** / **Adesilex PG2** has hardened, carefully peel the protective film from the upper side of the plate bonded to the element or structure.
If the strengthened areas need to be treated with a finishing product, remove the protective film from the exposed side of **Carboplate**, apply a layer around 1 mm thick of **MapeWrap 11** / **MapeWrap 12** or **Adesilex PG1** / **Adesilex PG2**, and broadcast the resin while still wet with 1.2 to 1.9 mm quartz sand.
Once the epoxy products used in the system have hardened (approx. 1-2 days at +23°C), the surface can be finished off with a skim-coat of fine-textured cementitious compound such as **Planitop 200** or **Planitop 210** (refer to the related Technical Data Sheet).
If the strengthened area is to be covered by a false ceiling, the aforementioned finishing procedure is not required.
For external applications, protect the system once the epoxy systems have completely hardened by applying a coat of **Mapelastic** or **Mapelastic Guard** two-component, elastic cementitious mortar or, as an alternative, products from the **Elastocolor** range (refer to the related Technical Data Sheet).
This product forms an efficient barrier against UV rays, which makes it particularly recommended for structures exposed to direct sunlight.
To protect the system from fire it may be dressed with panels, which are usually made from calcium-silicate, or with a layer of intumescent render, as specified in article 4.8.2.3 of CNR DT 200 R1/2013.

PRECAUTIONS DURING AND AFTER APPLICATION

- The temperature during application must be at least +5°C (or +10°C if **MapeWrap Primer 1** had been used) and the structure must be dry and protected from rain and dust carried by the wind.
- After completing the application, make sure the treated surfaces are kept at a temperature over +5°C (or over +10°C if **MapeWrap Primer 1** had been used).
- Protect strengthened surfaces from rain for at least 24 hours if the temperature does not drop below +15°C, or for at least 3 days if the temperature is lower.

CLEANING

MapeWrap 11/ **MapeWrap 12**/**Adesilex PG1**/ **Adesilex PG2** form a strong bond, also on metal: tools should be cleaned with solvent (such as ethanol, toluene, etc.) before the adhesive hardens.

PACKAGING

Carton boxes each containing a 25 m roll. Different lengths are available upon request.
Standard widths: 50, 100, and 150 mm. Different widths are available upon request.

CONSUMPTION OF ADHESIVE

The consumption rate for **MapeWrap 11**, **MapeWrap 12**, **Adesilex PG1**, and **Adesilex PG2** depends on the width of **Carboplate** and is usually around:

- 50 mm plate: 160-200 g/m
- 60 mm plate: 200-250 g/m
- 80 mm plate: 250-320 g/m

- 100 mm plate: 320-400 g/m
- 120 mm plate: 400-480 g/m
- 150 mm plate: 480-600 g/m

STORAGE

Store in a covered, dry area.

SAFETY INSTRUCTIONS FOR PREPARATION AND APPLICATION

Carboplate is an article and referring to the current European regulations (Reg. 1906/2007/CE - REACH) does not require the preparation of the Safety Data Sheet. During use, it is recommended to wear gloves and goggles and follow the safety requirements of the workplace.
PRODUCT FOR PROFESSIONAL USE.

TECHNICAL DATA (typical values)

PRODUCT IDENTITY	
Matrix:	epoxy resin
Reinforcement:	high-strength carbon
Colour:	black

CHARACTERISTICS OF PRODUCT

		Carboplate E 170						Carboplate E 200						Carboplate E 250					
Density (g/cm³):		1.6						1.6						1.6					
Fiber content (%):		68						68						68					
Width (mm):		50	60	80	100	120	150	50	60	80	100	120	150	50	60	80	100	120	150
Resistant section (mm²):	thickness 1.2 mm	60	72	96	120	-	-	60	72	96	120	-	-	60	72	96	120	-	-
	thickness 1.4 mm	70	84	112	140	168	210	70	84	112	140	168	210	70	84	112	140	168	210

FINAL PERFORMANCE ACCORDING TO EN 13706-1-2-3

	Carboplate E 170	Carboplate E 200	Carboplate E 250
Modulus of elasticity - average value:	160 GPa	190 GPa	250 GPa
Tensile strength - average value:	2,900 MPa	3,300 MPa	2,500 MPa
Tensile strength - characteristic value:	2,700 MPa	3,100 MPa	2,400 MPa
Elongation at break - average value:	1.8%	1.8%	1%
Elongation at break - characteristic value:	1.6%	1.6%	0.95%

FINAL PERFORMANCE ACCORDING TO EN 2561

	Carboplate E 170	Carboplate E 200	Carboplate E 250
Modulus of elasticity - average value:	170 GPa	200 GPa	250 GPa
Tensile strength - average value:	3,100 MPa	3,300 MPa	2,500 MPa
Elongation at break - characteristic value:	1.6%	1.4%	0.77%

WARNING

Although the technical details and recommendations contained in this product data sheet correspond to the best of our knowledge and experience, all the above information must, in every case, be taken as merely indicative and subject to confirmation after long-term practical application; for this reason, anyone who intends to use the product must ensure beforehand that it is suitable for the envisaged application.
Please refer to the current version of the Technical Data Sheet, available from our website www.mapei.com

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